Remarks/Arguments

Claim Rejections – 35 USC 102

To anticipate a claim, the prior art reference must teach every aspect of the claim. Furthermore the alleged identical invention must show in as complete detail as is shown in the supposedly anticipated claim.

Rejection of claims 1-4 under 35 USC 102 (b) as being anticipated by Tavkhelidze (US6281214).

Claims 1 – 4 stand rejected under 35 USC 102 (b) as being anticipated by Tavkhelidze (US 6, 281, 514).

The key distinction between the current invention and that disclosed in '514 lies in the different function of the indents disclosed in each, this distinction being reflected in their respective physical structures.

'514 discloses an indent height derived based on an average velocity of a free electron capable of participating in electron transport. The result is enhanced electron transport of these electrons (col. 5, lines 17 – 26). This has the advantage of increasing efficiency by lowering the effective work function of the emitting surface (col. 6, lines 19-24) and means that for a given current more average energy electrons are emitted. However, it does not qualitatively or quantitatively change the cooling power and efficiency of those electrons emitted since there is no filtering of energies of emitted electrons.

In contrast, the current invention discloses an indent height corresponding to the wavelength associated with high energy free electrons, rather than average energy free electrons (page 2, lines 32 – 35, pg. 3, lines 10-12). This has the effect of blocking the tunneling of those very electrons that the device disclosed in '514 would preferentially transmit.

The structural difference between the prior art and the current invention thus lies in the relative dimensions of the indents. The claimed device performs differently to the prior art device and

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overcomes a problem that the prior art device only compounds by encouraging transport of average energy free electrons that do not produce efficient cooling.

Claims 1 and 3 have been amended in order to more explicitly distinguish the current invention over the prior art. No new material is added by these amendments, since the specification explicitly refers to the filtering effect of the instant potential barrier; namely the blockage of lower energy electrons and transmission of higher energy electrons (page 2, paragraphs 2 and 3 and page 4, lines 27-29).

In view of the amendments made to claims 1 and 3 and the arguments above, Applicant respectfully requests that Examiner withdraw his rejection of claims 1-4 under 35 USC 102 (b) as being anticipated by US 6, 281, 514.

Claim Rejections – 35 USC 103(a)

Rejection of claims 1-4, 6-10, 14, 16 and 18 under 35 USC 103 as being anticipated by Ghoshal (20020092557) in view of Tavkhelidze

Claims 1-4, 6-10,14,16 and 18 stand rejected under 35 USC 103(a) as being unpatentable over Ghoshal in view of Tavkhelidze.

In view of the amendments made to claims 1 and 3 and the corresponding arguments above in which Applicant makes clear the distinction between the indented potential barrier of '514 and that of the current invention, Applicant believes that claims 1-4, 6-10, 14, 16 and 18 are patentable over the prior art of Ghoshal in view of Tavkhelidze in '514.

Furthermore, the current application is a continuation-in-part of U.S. Patent Application No. 10/508,914, whose earliest priority date is March 22, 2002, which is before Ghoshal was published. Even supposing the combination of Ghoshal with '514 is predictable and suggested by the two references, which Applicant will respectfully show below not to be the case, the device produced thereby would pertain to subject matter disclosed in 10/508,914 and therefore be subject to its priority date.

In addition, Applicant believes that Ghoshal and Tavkhelidze in '514 themselves teach away from the suggested combination.

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With regards to claim 1, Examiner states that Ghoshal is silent as to the geometry of the indents of the potential barrier. Applicant respectfully disagrees: Ghoshal is not silent as to the geometry of the indents but rather discloses a distinct zig-zag shaped surface comprising metal tips. The unique properties of Ghoshal's invention derive from the geometry of these tips (see Abstract). To suggest that the current invention is anticipated by Ghoshal in view of '514 is equivalent to suggesting that there is some motivation to remove Ghoshal's tips, the key part of Ghoshal's invention, and replace them with the indented surface disclosed in '514. Applicant will show below that not only is this modification not suggested, but it would actually deprive Ghoshal's invention of its advantages.

Ghoshal's tips are disclosed as having several key properties: Firstly, increased lattice mismatch at the point of the tip leads to decreased lattice thermal conductivity (pg 9, 1st paragraph). Secondly, electrons are confined to 'dimensions smaller than the(ir) wavelength' (pg. 9, 2nd paragraph), thereby increasing the local density of states. Furthermore, 'the closer to perfectly pointed the tip is, the fewer number of superlattices needed to achieve the temperature gradient' (pg. 17, 2nd paragraph). All of these advantages would be negated by the replacement of Ghoshal's tips with a planar indented surface which would not create lattice mismatch, nor confine electrons nor reduce the number of superlattices required. In particular, in '514, the electrons are not confined to dimensions smaller than the wavelength, since the indent width is of the order of double the wavelength (col. 5, line 7).

Based on this, Applicant respectfully suggests that the modification of Ghoshal's potential barrier according to the pattern proposed in '514 would not be obvious, given that this would obviate all the advantages of Ghoshal's invention.

Furthermore, with the exception of the embodiment shown in Ghoshal's Fig. 14, Ghoshal's device does not work by the mechanism of thermotunneling and the pointed tips do not constitute a potential barrier, but rather are conducting and allow current to flow through them. To this end tip elements **222**, **224**, **216** and **218** are all made of conducting materials as opposed to the instant potential barrier which comprises an insulating material (claim 6).

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The motivation to replace one type of tunnel barrier with another would therefore be absent in relation to all of Ghoshal's embodiments with the exception of Figure 14, since in all other embodiments Ghoshal's tips do not constitute a tunnel barrier but rather a conductive surface.

Suppose a PHOSITA modified the pointed tips of Ghoshal shown in the embodiment in Fig. 14 to become the planar indents described in '514. An evacuated gap is now present between the newly formed indents and the opposing surface. There is no such gap between the tunnel barrier and the opposing surface in the current invention (see all Figures), so modifying Ghoshal in this way would not produce a device that reads on the current invention. In order approach the current invention, the PHOSITA would then have to remove the vacuum. But on the removal of the vacuum, current flow would occur because Ghoshal's tips are conducting and the whole tunneling effect would be lost. So, the PHOSITA would have to replace the material comprising Ghoshal' tips.

In summary, even assuming that a combination of Ghoshal with '514 would be motivated, a PHOSITA would have to implement two further inventive steps in order to approach the current invention. This would seem to contradict the notion that the current invention is obvious in view of Ghoshal in view of Tavkhelidze in '514.

In light of the arguments above, Applicant respectfully requests that Examiner withdraw his rejection of claims 1-4, 6-10,14,16 and 18 under 35 USC 103 (a).

Rejection of claim 11-13, 17, 19-20 under 35 USC 103 as being anticipated by Ghoshal in view of Tavkhelidze in view of Saida (US 5866930)

Claims 11-13, 17, 19-20 stand rejected under 35 USC 103(a) as being unpatentable over Ghoshal in view of Tavkhelidze in view of Saida (US 5866930). In light of the arguments above applicant believes that these claims are patentable over the prior art. Applicant therefore respectfully requests that Examiner withdraw his rejections of claims 11-13, 17, 19-20 in view of Ghoshal in view of Tavkhelidze in view of Saida.

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Rejection of claim 15 under 35 USC 103 as being anticipated by Ghoshal in view of Tavkhelidze in view of Saida in view of Brannon

Claim 15 stands rejected under 35 USC 103(a) as being unpatentable over Ghoshal in view of Tavkhelidze in view of Saida in view of Brannon. In view of the amendments made to claim 1 and the arguments above Applicant believes that claim 15 is patentable over the prior art of Ghoshal in view of Tavkhelidze in view of Brannon.

Applicant therefore respectfully requests that Examiner withdraw his rejection of claim 15 under 35 USC 103 (a).

Applicant respectfully submits that this application, as amended, is in condition for allowance, and such disposition is earnestly solicited. No new material has been added by these amendments. If the Examiner believes that discussing the application the Applicant over the telephone might advance prosecution, Applicant would welcome the opportunity to do so.

Respectfully submitted,

/A.Tavkhelidze/

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